RESTAURANT FOOD PREPARATION LINE

Related Case

This application claims the benefit under 35 U.S.C. § 119(e) of U.S. provisional application Serial No. 60/038,653, filed on February 21, 1997.

Background of the Invention

Field of the Invention

The present invention relates in general to the efficient preparation of a comestible product. In particular, the present invention relates to an improved food preparation line of the type used in a restaurant.

Related Art

Restaurants, including quick-service restaurants, typically employ food preparation lines. For example, a common food preparation line is a straight line having several work stations. The workers build a meal as it progresses from a starting end, through several work stations, to a serving end. At the serving end, the end food product can be readied for serving or packaged for take-out or delivery orders. Accordingly, these food preparation lines require many workers and an accompanying large working area.

Prior straight food preparation lines have several additional drawbacks. The preparation lines require interruptions in the preparation process while being stocked with food product. The typical food preparation line also merely prepares the food while others package it for the customers. In addition, the workers commonly must transfer the food across the relatively large distances between the preparation line and the counter space used to serve the customers. The long transfer requires more time, can result in food product dropping, and results in larger food preparation areas or decreased seating capacity.

Summary of the Invention

Accordingly, there is a need for a restaurant which employs a food preparation line of ergonomic construction which requires fewer workers. In addition, there is a need for a food preparation line which allows the food product supply to be

maintained without interrupting the workers preparing the food products. There is a further need for a food preparation line which allows the workers preparing the food product to readily package a food product for the customer.

An aspect of the present invention thus involves a food preparation line comprising a first section and a second section. The second section lying generally normal to the first section. A third section positioned next to and extending away from the second section. A heated storage compartment positioned on one of the sections and a cooled storage compartment positioned on another one of the sections.

In a preferred mode, the preparation line is formed in a "U" shape by three sections: a first section, a second section and a third section. The first and third sections form the legs of the U-shaped line, while the second section forms the bite of the "U" (i.e., the section of the U-shaped line that extends between the side legs). A hot ingredient well (e.g., a steam table) is positioned near a corner formed either by the first and second sections or by the third and second sections. The hot ingredient well is arranged to lie at or near a working level of the preparation line. An open produce bin is arranged on the second section of the line. At least one order display is positioned on the line at approximately eye level. The order display(s) can be arranged at a location either near the hot ingredient well and/or near the produce bin. On the third section of the line, a tray lowerator is located generally near an outer end (i.e., distal of the second section) of the third section.

In a preferred embodiment, one of the order displays is located proximate to the first section of the line and the other order display is located proximate to the third section of the line. This allows the line workers on either side of the line to easily view the order displays.

The food preparation line also includes a steam cabinet that is arranged on the first section generally near the hot ingredient well. In between the steam cabinet and hot ingredient well, a bean cup dispenser is positioned. A hot cabinet desirably is positioned generally below the steam cabinet on the first section of the preparation line.

An ingredient dispenser is preferably located near the hot ingredient well to dispense a variety of hot foods, such as, for example, but without limitation, ground

beef and beans. A heated shelf also is located near the ingredient dispenser. The heated shelf desirably is adapted to store a variety of food ingredients, including, but without limitation, taco shells, tortilla shells and like masa-based products. In a preferred embodiment, nozzles of the ingredient dispenser lie above the hot ingredient well, and the heated shelf lies above and behind the ingredient dispenser nozzles. This portion of the food preparation line desirably lies at the corner formed by the first and second sections. At least one indicator is located near the hot ingredient well and cooperates with a diagnostic system that continuously monitors the function of the hot ingredient well. The indicator for this diagnostic system preferably is an audio alarm (either sound or voice), a visual display or a light indicator. Located near the hot ingredient well and the indicator is a diagnostic system for a hot ingredient well. The diagnostic system assesses the water level within the hot ingredient well (if applicable), the functioning of the heating elements, and the automatic fill procedure (if applicable), and triggers the indicator upon sensing an abnormal condition for any of these elements or in any of the procedures.

The food preparation line includes a timing system that clocks the time that each ingredient batch is on the line. Once the measured time reaches a preselected time for the particular ingredient, the timer signals the indicator to alert the line worker. In this manner, ingredients do not remain on the food preparation line for longer than an established time set in accordance with safety standards.

In a preferred embodiment, the food preparation line also includes a hanging storage system that is desirably used to store packaging materials, such as, for example, wraps, containers, boxes, and/or bags; however, the storage system can also be used to store other items as well. The hanging storage system desirably is located on the second section of the preparation line, above the produce bin.

The food preparation line additionally can include a taco rail. The taco rail desirably is located in front of the produce bin on the second section of the line. A waste container preferably is located below the taco rail in a position to receive waste accumulated near the produce bin and the taco rail.

A number of additional features can be incorporated into the present food preparation line. For instance, the preparation line can include an improved quesadilla

warmer that has a split lid. The split lid permits access to the warmer through one lid while the second remains closed. The efficiency and the warmer's capacity thus is improved over prior warmers.

The third section of the line also desirably includes a packaging storage compartment located near a tray dispenser. A bag opening device is used to open bags and is located on the line near the packaging storage compartment and tray dispenser.

In accordance with another aspect of the present invention, disclosed is a steam cabinet with a fan unit positioned outside the steam flow. The steam chamber is formed by a plurality of side panels. One side of the steam chamber is defined by a laminar air flow extending across an open section of the chamber thereby creating an air curtain.

In a preferred embodiment, the steam cabinet also includes a swinging door that extends partially across the open side of the chamber. The bottom edge of the swinging door is in contact, along its entire length, with the laminar air curtain. A heater is be positioned within the steam chamber on the top surface. The heater emits heat of a sufficient degree to prevent condensation from forming on the top surface within the steam chamber. An exhaust system is positioned on the top surface of the steam chamber, above the heater.

In accordance with another aspect of the present invention, an ingredient dispenser for pumping predetermined quantities of food ingredients is disclosed. The ingredient dispenser includes a hopper that holds enough ingredient to sufficiently supply the food preparation line for a period of time. The hopper is connected to a positive displacement pump device which draws ingredient from the hopper in metered amounts. The positive displacement pump device further forces the withdrawn ingredient portion through a separate nozzle on the food preparation line for dispensing the ingredient.

In a preferred embodiment, the positive displacement pump is a piston-type pump and operates with a two-position valve. The valve includes a chamber with an inlet port that communicates with the hopper, an outlet port that communicates with the nozzle, and a port to which the pump is connected. A valve member is moved

within the chamber to selectively connect the pump with the hopper and with the dispensing nozzle. To withdraw ingredient from the hopper, the valve member is moved (e.g., rotated) to a position which connects the pump to the hopper and closes off the connection to the nozzle. The pump's piston moves away from the valve to draw ingredient from the hopper. The degree of piston movement is proportion to the volume of withdrawn ingredient so as to meter the amount of ingredient being dispensed. The valve member is then moved to a position in which the pump is connected to the nozzle. In this position the valve member closes off the connection between the hopper and the pump. The pump then moves toward the valve in order to force ingredient through the nozzle. Again, the degree of piston movement controls the amount of ingredient dispensed.

In accordance with an additional aspect of the present invention, a wrap storage system is disclosed. The system includes hanging modular shelves with attachment means for hanging the shelves. Positioned within the shelves are removable wrap containers and carton dispensers.

In a preferred embodiment, the shelves have hooks located on the top edge of the side panels. The hooks are configured to receive a rod extending along an food preparation line. The shelves are further configured to receive wrap containers of varying sizes and form. Within the wrap containers are cartons of product wrappers for various menu items. An elongated slot, cut along the inside of the bottom panel of the shelf, receives an elongated flange on the wrap containers. The elongated flange on the wrap containers fit at an angle within the slot in the shelf. The shelves are hung on a rod mounted at any point along the food preparation line.

A further aspect of the present invention involves a food preparation line having two portions. The first portion abuts the second portion. Desirably, the first portion includes a warmer and a heating device which are positioned to be within the arm span of a single worker. The second portion desirably includes an accompaniments container located proximate the heating device. The second portion also includes a packaging dispenser. The accompaniments container and the packaging dispenser are advantageously located within about six feet of each other so as to be within the arm span of a single worker.

Further aspects of the present invention will be apparent in view of the disclosure below.

Brief Description of the Drawings

These and other features of the invention will now be described with reference to the drawings of two preferred embodiments which are intended to illustrate and not to limit the invention, and in which:

Figure 1 is a top plan view of a food preparation line that is configured in accordance with a first preferred embodiment of the present invention;

Figure 2 is a front elevational view of a first section of the preparation line as viewed in the direction of lines A-A of Figure 1;

Figure 3 is front elevational view of a second section of the preparation line as viewed in the direction of lines B-B of Figure 1;

Figure 4 is a front elevational view of third section of the preparation line as viewed in the direction of lines C-C of Figure 1;

Figure 5 is a front elevational view of a corner section of the preparation line as viewed in the direction of lines D-D of Figure 1;

Figure 6A is a sectional side view of a steam cabinet configured in accordance with a preferred embodiment of the present invention;

Figure 6B is an enlarged sectional view of the area within circle 6B of Figure 6A and illustrates a door drip edge;

Figure 7 is a rear elevational view of the steam cabinet of Figure 6A;

Figure 8 is a perspective view a shelf of a hanging storage system that is shown in Figure 1 and is configured in accordance with a preferred embodiment of the present invention;

Figure 9 is an enlarged perspective view of the area within Circle 9 of Figure 8 and illustrates a hook of the storage shelf;

Figure 10 is a perspective view of a container holder of the hanging storage system of Figure 1;

Figure 11 is a side elevational view of the container holder of Figure 10;

Figure 12 is a perspective view of a wrap holder of the hanging storage system of Figure 1;

Figure 13 is a side elevational view of an ingredient dispenser of the food preparation line of Figure 1;

Figure 14A is an enlarged, partial sectional, side view of a pump and valve assembly of the ingredient dispenser of Figure 13, and illustrates the pump in a metering stoke of the dispensing cycle;

Figure 14B illustrates the pump and valve assembly with the pump in a delivery stroke of the dispensing cycle; and

Figure 15 illustrates a top plan view of a food preparation line that is configured in accordance with another preferred embodiment.

Detailed Description of the Preferred Embodiment

Figure 1 illustrates a food preparation line 1 that is configured in accordance with a first embodiment of the present invention. The preparation line 1 is designed to improve the speed of service (i.e., shorten individual food preparation time) while reducing the number of employees on the preparation line, as well as to improve the consistency of ingredient portions between like products. In particular, the food preparation line of the present invention advantageously allows two workers to efficiently perform the work of at least three workers in a quick-service restaurant environment. The preparation line 1 is also preferably self monitoring to indicate the malfunction of any of the various components of the line. In addition, the preparation line measures the duration of time that ingredients remain on the line for health concerns. The preparation line 1 thus has particular utility in "quick-service" restaurants. The preparation line 1 is accordingly illustrated and described in connection with a quick-service, mexican-entree restaurant, such as, for example, a Taco Bell® restaurant. It shall be understood, however, that the skilled artisan can readily adapt the preparation line 1 to be used in other types of food preparation facilities or restaurants.

Figure 1 best illustrates a desired "U" shape of the food preparation line 1. For this purpose, the preparation line 1 includes a first section 3, a second section 5, and a third section 7 that are arranged to form a "U" shape. The second section 5 extends between corresponding ends of the first and third sections 3, 7, while the first and third sections 3, 7 extend generally parallel to each other. Each section 3, 7

terminates at an outer end 2, 52. The modular nature of the line 1 created by the separate sections 3, 5, 7, however, allows the line to be arranged in other configurations. The line 1 need not be formed in a perfect U-shape with the first and third sections 3, 7 parallel to each other and the second section 5 perpendicular to the other sections 3, 7, as will be described below.

A heated storage compartment is provided along the first section of the preparation line. The heated storage compartment can be any of a number of devices designed to maintain food products at an elevated temperature. In the illustrated embodiments, the heated storage compartment can be either the steam cabinet 100 or the heating cabinet 14. One skilled in the art will appreciate that the heated storage compartment can also comprise a bun warmer, hot plate or other similar devices.

A heating device is also provided along the preparation line. The heating device of the illustrated embodiments is a steam table 20. The heating device can either maintain food at an elevated temperature or cook food items being prepared along the food preparation line. One skilled in the art will readily recognize that the heating device can be an oven, a grill, a range top, a hot plate or other similar devices.

A cooled storage compartment is provided along the second section of the preparation line. The cooled storage compartment can be any of a number of devices designed to maintain food products at a temperature below room temperature. In the illustrated embodiments, the cooled storage compartment can be either the open produce bin 32 or the refrigerators 38. One skilled in the art will appreciate that the cooled storage compartment can also comprise a cool rail, ice chest or other similar devices.

As is common to each section, a counter top 17, 34, 47 extends along the length of the first, second and third sections 3, 5, 7, respectively, at about waist height (e.g., 2½ to 4 feet high). Along the edges of the counter tops 17, 34, 47, as well as along the edges of the shelves and cabinets, a plurality of mounting studs 19 (Figure 2) can be placed. The mounting studs 19 desirably are spaced apart at eight (8) inch intervals, center to center, and are shaped to cooperate with key holes formed in a variety of movable line components, such as, for example, removable shelving, dispensers and storage devices.

Along this line, the line 1 can include one or more removable shelves attached to a side edge of one of the counter tops. For instance, in the illustrated embodiment, a removable angled shelf 42 is positioned at the corner 11 between the second and third sections 5, 7. The angled shelf 42 is positioned at the surface level of the preparation line 1, even with the counter tops 34, 47, so that food items can be set upon the shelf before they are packaged. The angled shelf 42 includes a plurality of key holes formed along side edges of the shelf which cooperate with the mounting studs 19 to releasably attach the shelf 42 to the second and third sections 5, 7.

A second removable angled shelf 43 desirably is located at the corner 9 between the first and second sections 3, 5. The angled shelf 43 is positioned at the surface level and is releasably attached to the sections 3, 5 using the mounting studs 19.

As illustrated in Figures 1 and 2, the first section 3 includes a steam cabinet 100 near the outer end 2 of the section 3. Because the preparation of many food items initially begin with tortillas, the steam cabinet is arranged at the starting point of the preparation line 1. As Figures 1 and 2 illustrate, the steam cabinet 100 desirably lies on a shelf above of the counter top 17 of the first section 3.

The steam cabinet 100, which will be described in detail below, has a semi-enclosed steam chamber. In the exemplary application, the steam cabinet 100 stores flour tortillas and keeps them warm pending use during food product preparation. For this purpose, the steam cabinet produces 90-100% humidity within the steam chamber and maintains a temperature ranging between 120-140° F within the chamber.

The steam chamber desirably has a sufficient size so as not to require restocking during extended periods of use. For example, the quantity of supply should be sufficient to not require any additional stocking during a three-hour lunch period in the middle of the afternoon. For this purpose, the steam chamber advantageously includes four shelves which are sized to hold 192 tortillas of 10.5 inch diameter and 288 tortillas of 6.5 inch diameters.

The steam cabinet 100 has an open face which opens directly into the steam chamber. An air curtain keeps the steam within the chamber, as described below.

The open face eliminates the need to constantly open and close a front door when getting a tortilla.

The steam cabinet 100 also includes a rear door that opens directly into the steam chamber. The rear access to the steam chamber allows tortillas to be loaded into the steam cabinet 100 without interfering with the operation of the worker on the preparation line 1.

Directly below the steam cabinet 100 is wrap storage station 12. From this location, a worker places a tortilla from the steam cabinet 100 directly on a wrap (i.e., paper and/or foil sheets).

The wrap storage station 12 includes a plurality of tiered compartments that are sized to hold wraps in a flat manner. This layout makes the wraps easier to discern from one another, easier to access and easier to grab. Finger holes are also provided to further assist with the latter advantage. The storage station desirably includes at least six compartments which are adequately sized to hold a sufficient amounts of wraps to last through a three-hour rush period (e.g., a daily lunch period).

The storage station 12 sits atop the counter top 17 with the steam cabinet 100 sitting on the storage station 12. The counter top 17 in front of the station 12 can be used to prepare food items. For example, flour tortillas removed from the steam cabinet 100 can begin their preparation on the counter top 17.

A heated cabinet 14 is located on the line's first section at a position directly below the wrap storage station 12. The heated cabinet 14 is configured to maintain a predetermined quantity of ingredients before the ingredients are placed on the line. The quantity of ingredients desirably is sufficient to not require restocking during extended periods of use. For example, the quantity of supply can be sufficient to not require any additional stocking during a three-hour lunch period in the middle of the afternoon.

In the illustrated embodiment, a half height heating cabinet 14 is used. The cabinet 14 desirably includes a front door and a rear door to allow loading from the rear so as not to the disturb the line workers. A suitable heating cabinet 14 is commercially available from Bevles, of Chino, California.

Located adjacent to the steam cabinet 100 is a bean cup dispenser 16. In the illustrated embodiment, the bean cup dispenser 16 is attached to the steam cabinet with key hole slots to allow the dispenser 16 to be movable. The bean cup dispenser 16 is an enclosed sanitary chamber configured to receive a predetermined quantity of cups. Any of a variety of conventional cup dispensers can be used for this purpose. A suitable cup dispenser is available from Antunes, of Addison, Illinois. It also will be understood that the bean cup dispenser 16 can store cups for products other than pinto beans. For example, extra red sauce, nacho cheese, meat, or other food items can be placed in the cups. Accordingly, the line 1 can include more than one cup dispenser positioned at or near this location.

The cup dispenser 16 desirably includes a plurality of mounting studs 19 that extend vertically along the dispenser 16. As best seen in Figure 2, one or more paper wrap dispensers 45 (e.g., soft taco wrap dispensers) are removably attached to the side of the dispenser 16 for easy access by the line worker.

Below the bean cup dispenser 16 is a section of the generally flat working counter top 17. This space also can be used as a food preparation surface.

A water filtration system 18 is located below the bean cup dispenser 16 and the counter top 17. The filtration system filters and regulates the water used in a steam well 20 on the line.

A steam table lies at the corner 9 formed between the first and second sections of the line 1 in the illustrated embodiments. As best seen in Figure 5, the steam table 20 is positioned at the surface level of the counter top 17 which allows food to be served quickly and smoothly. The steam table 20 maintains a high-temperature water bath heated by heating elements. In the illustrated embodiment, the steam table 20 includes three full size compartments. Each compartment is heated by a 20 amp heating element. Though the line is described as including a steam table, it is understood that a drop-in dry hot well system can be used as well. Additionally, as will be appreciated by those skilled in the art, the steam table may also be replaced by a grill or other cooking surface.

Pans holding an assortment of food ingredients are placed in the steam table 20. It will be understood that the steam table 20 can accommodate pans of various

sizes. For example, three one-third pans can fit within each compartment of the steam table 20, as will 18 one-sixth pans and 27 one-ninth pans. The pans contain ingredients that need to be kept at a warm temperature. For example, additional meat, beans and red sauce are stored in pans in the steam table 20. In addition to these ingredients, green sauce, nacho cheese and chili, as well as other ingredients, are stored in pans within the steam table 20.

Figures 1 and 3 illustrate a steam well digital control panel 28 positioned on the second section 5 adjacent to the corner 9 and the steam well 20. In applications having a steam table, the water level in the steam table 20 is controlled by the digital control system 28, which is located on the second section 5 below the surface level 34, as seen in Figure 3. The digital control system 28, through the use of probes in the steam table, operates the water fill system 18 (Figure 1), which, in turn, adds water to the steam table 20. A manual drain is used to drain water from the steam wells when cleaning the line. Should the water level drop below a certain level and remain below after the fill operation (as would be the case if a line worker left the manual drain open), the digital control system 28 will alert the line worker of this abnormal condition and will turn off the heating elements if the problem persisted.

The digital control system 28 also monitors the conditions of the heating elements in the steam table 20 to ensure they are operating properly. The digital controls 28 found to be suitable for controlling the steam table 20 of the present invention are commercially available from Digital Knights of Aliso Viejo, California.

Above the digital controls 28 are indicators 26. It will be understood that the indicators 26 can be lights, audio alarms (either verbal or non-verbal), or visual displays. The indicators 26 indicate diagnostic changes in the water level and water temperature in the steam table 20.

As shown in Figure 2, above the order display 22 is a timer 21 that, for food health reasons, monitors the length of time that food ingredients have been exposed or open to the atmosphere. The timer 21 preferably has twenty-one channels, each assigned to a different ingredient. The timer 21 can monitor the time in which up to twenty-one ingredients have been in their respective environments. The timer 21 counts down from a maximum period of time in which each ingredient can safely

remain in its particular environment. The preferred timer 21 counts down from this predetermined time towards zero. When the timer 21 counts down to zero for a particular ingredient, the timer 21 will indicate that the exposure time for the ingredient has lapsed, and a line worker will replace the ingredient with a fresh supply of the ingredient.

With reference to Figures 1 and 5, an ingredient dispenser 120, which will be described in fuller detail below, is located behind the steam table in the corner 9 between the first and second sections 3, 5. The ingredient dispenser 120 includes nozzles 126 that are arranged above the steam table 20 for easy access. The ingredient dispenser precisely pumps predetermined amounts of ingredient when activated, as well as dispenses ingredients more quickly than can be accomplished by hand.

For this purpose, the ingredient dispensing unit 120 includes a positive displacement pump to dispense food ingredient in precise, predetermined portions. The ingredient dispenser 120 can be used to dispense a number of different ingredients. For example, refried beans, ground beef and red sauce can be dispensed through the ingredient dispensing unit 120. Each food ingredient would require its own separate ingredient dispenser.

As illustrated in Figures 1 and 5, in corner 9, defined by the joining of the first section 3 and the second section 5, is a heated shelf 24. The heated shelf 24 is heated by one or more lamps and is positioned above the ingredient dispensing unit 120 at approximately eye level and is designed to store a predetermined quantity of ingredient. The quantity of ingredient advantageously is sufficient to not require restocking during extended periods of use. For example, the quantity of supply desirably is sufficient so as not to require any additional stocking during a three-hour lunch period in the middle of the afternoon. In the exemplary application, the heated shelf 24 desirably stores ingredients such as taco shells, tostada shells, nachos and other food items that need to be kept crisp. The ingredients are, thus, kept at a predetermined, warm temperature.

As best seen in Figures 2 and 5, the order display 22 is positioned above the steam table, on the back facing, below the heated shelf 24. The line worker can easily

read the orders to coordinate product preparation from the display. The display 22 desirably is a flat screen, such as the type available commercially from Datalux, of Winchester, Virginia, in order to save space on the line.

As illustrated in Figure 3, an auxiliary ingredient dispenser 27 is positioned above the digital control panel 28. The ingredient dispenser 27 permits line workers to dispense ingredients such as, for example, but without limitation, sour cream, guacamole and/or beef, in accurate portions. Moreover, the easy accessibility of the ingredient dispenser 27 increases the speed in which food items can be prepared. An ingredient dispenser found to be suitable in the food preparation line 1 is a dispenser commercially available from Frymaster of Shreveport, Louisiana.

A wrap storage station desirably is positioned between the auxiliary ingredient dispenser 27 and the control panel 28. The storage station is convenient located in proximity to the heated shelf 42, ingredient dispensers 120, 27 and the steam table 20.

On the second section 5, adjacent to the auxiliary ingredient dispenser 27, is a cheese melter 32. The cheese melter 32 is located on a shelf 51 that extends above the counter top 34. The cheese melter 32 desirably uses hot steam heat to melt cheese on some products. For this purpose, a source of filtered water is connected to the cheese melter 32.

A quesadilla warmer 53 is located on the counter 47 of the third section 7. The quesadilla warmer 53 preferably has two independent lids. The quesadilla warmer 53 has a pair of lids whereby one lid to the quesadilla warmer 53 can remain closed while the other lid is opened to insert or remove product from the warmer 53. This configuration permits a line worker to place a quesadilla into the quesadilla warmer 53 via one lid while another quesadilla is already inside the quesadilla warmer 53. Line workers thus can cook a second quesadilla without waiting for the first cycle to complete. That is, the split lid allows the quesadilla warmer 53 to function essentially as two quesadilla warmers 53 in the space of one. A warmer found to be suitable as a quesadilla warmer 53, without the split lid improvement, is a warmer manufactured by Star Manufacturing of St. Louis, Missouri.

As illustrated in Figures 1 and 3, a produce bin 36 is located on the second section 5, below the cheese warmer 33. The produce bin 36 receives and store

predetermined amounts of produce. The quantity of produce stored within the bin 36 and an on-line refrigerator 38 desirably is sufficient so as not to require restocking during extended periods of use. For example, the quantity of supply can be sufficient to go without resupply for a three-hour period in the middle of the afternoon. In the preferred embodiment, the produce bin 36 holds a variety of produce to be added to food ingredients as they proceed along the preparation line 1 from the ingredient dispenser 120 or steam table 20. For example, accompaniments such as lettuce, tomatoes, olives as well as cheese and sour cream are added to the food items that proceed to the second section 5 of the preparation line 1. The produce bin 36 can hold five one-third pans and five one-sixth pans which, in turn, store the produce. The produce bin may be located proximate a Bloomington Rail, manufactured by the Delfield Co. of Mount Pleasant, Michigan.

As shown in Figures 1 and 3, above the produce bin 36 is a wrap storage system 150. The wrap storage system 150, which will be described in fuller detail below, is configured to receive predetermined quantities of product packaging. The wrap storage system 150 hooks on to the preparation line 1 and stores containers which, in turn, hold product packaging used to wrap the final product before delivery to the customer. The modular nature of the wrap storage system 150 allows it to be hung anywhere along the food preparation line 1. Such optimal positioning advantageously permits easy accessibility to product packaging.

Positioned in front of the produce bin 36 in Figure 3 is a taco rail 40. The taco rail 40 sits on the counter top 34 and is configured to receive tacos and maintain them in an upright position. The taco rail 40 positions tacos that have already been loaded with meat and/or beans in an upright position to permit the worker to load produce on the taco without the taco tipping and spilling produce. Accordingly, as shown in Figure 3, the taco rail extends between the steam table and the third section of the preparation line.

Below and proximate the counter top 34 and taco rail 40 is a waste container 30. Adjacent to the waste container 30 and below the produce bin 36 is another waste container 31. Produce that has fallen from food items during food preparation and settled on the counter top 34 or taco rail 40 can be easily swept into the waste

containers 30, 31 to ensure that the preparation line 1 remains sanitary. Waste containers 30, 31 found to be suitable for use with the present invention are commercially available from Rubbermaid of Winchester, Virginia.

Below the waste container 31 are dual refrigerators 38 to store cold items. The dual refrigerators are located, generally, at the floor level. Using two refrigerators 38 at this position increases storage capacity. For example the dual refrigerators 38 hold six full pans (or eighteen one-third pans), a quantity sufficient to fully supply the food preparation line 1 during a three hour peak period.

Figure 4 illustrates a monitor 50 proximate to the corner 11, formed by second section 5 and the third section 7. The monitor 50 is positioned on a shelf 41 that extends at approximately eye level along the third section 7. The monitor 50 indicates orders taken from the drive-through window. As the food items continue down the preparation line 1 from the ingredient dispenser 120 to the produce bin 36, line workers can reference the monitor 50 to determine what orders need to be prepared for the drive-through window. As the drive-through orders are prepared, they are handed through the pass-through area 49 to employees working the drive-through window.

On the third section 7, adjacent to the order display 50, is the wrap storage system 150. The wrap storage system 150, which will be described in fuller detail below, is configured to receive predetermined quantities of product packaging. The wrap storage system 150 holds product packaging corresponding to different food items. The wrap storage system 150 provides easy access to the packaging to further expedite food preparation. In addition, the wrap storage system 150 is modular so as to be removably mounted anywhere along the preparation line 1.

A bag opener 48 can be located adjacent to the wrap storage system 150, on the third section 7. As one bag is removed, the next is automatically opened. With the bag partially open, the worker is able to load the packaged items into the bag more quickly. This may enhance product flow through the entire preparation line 1. The bag opener 48 also has an increased bag capacity holding 130 #4 and 110 #6 bags. This supply is sufficient to eliminate any need to restock the bag opening 48 during a three hour lunch peak.

At the end of the preparation line 1, on the third section 7, is a tray dispenser 46. The tray dispenser 46 stores stacked trays within the lower level cabinet and dispenses the trays through an aperture in the counter top 47. By placing the trays in the cabinet, a sufficient supply of trays can be stacked in the dispenser 46 to eliminate the need to frequently stock the dispenser 46. The packaged food items, if not placed in the bags for a carry-out order, are placed on the trays to be delivered to the customer. The illustrated embodiment utilizes a tray lowerator.

A hand sink 45 and sanitizer 45a are positioned at the end of the third section 7 near the tray dispenser 46. The hand sink 45 has running water and a drain positioned on the bottom interior surface of the sink 45. Line workers entering the food preparation line 1 use the sink 45 to wash their hands in order to maintain sanitary conditions on the food preparation line 1. Similarly, when line workers exit the food preparation line, they can wash their hands in the sink 45. Moreover, as line workers prepare products on the food preparation line 1, any ingredients that come in contact with the line workers' hands can be quickly washed away. The sink 45 permits the line workers to conveniently and quickly wash their hands in order to maintain a sanitary food preparation line 1.

The sanitizer 45a is preferably located adjacent to the sink 45 as illustrated in Figure 1. The sanitizer is provided with a drain and desirably cannot be filled using the faucet associated with the sink. In use, the sanitizer holds a cleaning solution and towels. The cleaning solution can be either poured directly from a bottle or diluted using water transferred from the sink. No faucet is provided in the sanitizer to eliminate the possibility of accidental dilution of the cleaning solution.

Positioned in the corner 11 formed by the second section 5 and the third section 7, is a cash register (not shown). The cash register faces away from the line workers on the food preparation line 1 and towards the drive-through window. The register is accessible through the pass-through area 49 to employees working the drive-through window. The position of the register desirably permits employees working the drive-through window to conveniently enter orders and pick-up prepared products in the same location.

In the corner 11, underneath the surface level, is a refrigerator 38 (Figure 4). The refrigerator 38 can be accessed from the rear of the preparation line 1. The rear access refrigerator 38 is accessible to workers stationed at the drive-through window. The drive-through workers, thus, do not have to walk around the preparation line 1 to the refrigerator 38 to obtain milk, juice and other refrigerated items. Rather, these items can be stored in the rear access refrigerator 38 and accessed from behind the third section 7.

The above described preparation line 1 desirably is sized and arranged to allow just a few workers to handle the line. In the illustrated embodiment, the line 1 can be formed to have a foot-print of approximately 12 feet by six feet and be configured to allow two line workers to efficiently prepare ordered meals. The arm-span of the workers, positioned at the two inside corners of the preparation line, can cover the entire preparation line. Thus, advantageously, two workers can remain relatively stationary and complete each of the tasks along the food preparation line. Labor costs of course are reduced with the use of less workers on the line. The increased capacity of on-line storage within the produce refrigerator, heating cabinet and packaging storage stations, also eliminates the need to restock the line during times of peak production, such as, for example, during a three-hour lunch rush. As a result, a full time stock or prep person does not have to be employed, thereby further reducing labor costs.

In addition to reducing labor costs, the arrangement of the line 1 also improves the flow of meal preparation. That is, preparation proceeds in a more orderly fashion along the line. The speed of service in the restaurant advantageously increases.

The modular nature of several of the components of the line also readily accommodates changes to the restaurant's product menu. Special ingredients and packaging for new products are easily integrated into the overall arrangement of the preparation line.

The following will now elaborate upon the steam cabinet 100, the hanging storage system 150 and the ingredient dispensing system 120 of the food preparation line 1 described above.

Figure 6A illustrates a steam cabinet 100. A steam chamber 114 is generally defined by the walls of the steam cabinet 100. A fan unit 102 is desirably positioned outside the steam flow within the steam chamber 114. Adjacent to the fan unit 102 is a heating element 104. A laminar air flow passage 106 extends within and along the bottom of the steam cabinet 100. The air flow passage 106 further extends partially along the side the steam cabinet 100. An air curtain 110 defines a side of the steam chamber 114. Above and adjoining the air curtain 110 is a swinging door 112 that extends partially down along the open side of the steam cabinet 100. An exhaust system 116 is positioned at the top of the steam chamber 114. The exhaust system 116 includes a manual vane 111 (Figure 2). Directly below the exhaust system 116, and positioned at the top of the steam chamber 114, is a heating element 118. Within the steam chamber 114 is a shelving unit 113. The rear panel 115 of the steam chamber 114 is a door. As best illustrated by Figure 7, a latching mechanism 119 is mounted to the rear access door 115.

Flour tortillas or other food ingredients are placed within the steam chamber 114 on the shelving unit 113 to be heated. The cabinet is configured to maintain a predetermined quantity of tortillas. The quantity of tortillas desirably is sufficient to not require restocking during extended periods of use. For example, the quantity of supply can be sufficient to not require any additional stocking during a three-hour lunch period in the middle of the afternoon.

A steam well 108 is positioned at the bottom of the steam chamber 114, and within the steam well 108 are heating elements 117. A water bath is maintained in the steam well 108.

Figures 6A-7 illustrate a rear access door 115 comprising the back panel of the steam cabinet 100 and providing access to steam chamber 114. A latch unit 119 is mounted on the rear access door 115 and steam cabinet 100. A drip edge channel 101 is provided below the door as illustrated in Figure 6B. The drip edge 101 and sloping surface channels away any condensation which may accumulate on the inner surface of the door. Specifically, as shown in Figure 6B, any condensation which may form on the inside of door 115 will be pulled downward by gravity. The condensation will fall from the bottom of the door into the channel 101. Any condensation remaining

on the bottom of the door 115 will be swept into the channel by the edge 101a. Thus, the drip edge channel 101 traps condensation which forms of the inside and bottom surfaces of door 115. The channel can be configured to drain the condensation back into the steam well 108. As will be appreciated by those skilled in the art, the channel may also be drained to a location outside of the steam cabinet.

As illustrated by Figure 6A, the heating element 104 heats the air within the air flow passageway 106. The fan unit 102 forces the heated air through the air flow passageway 106. The heated air extends across the open side of the steam chamber 114 to the swinging door 112 thereby creating a laminar air curtain 110. The laminar air curtain 110 acts as a seal to prevent steam and heat from escaping into the atmosphere from the steam chamber 114.

As mentioned above, a water bath is maintained in the steam well 108. The water is heated to a predetermined temperature by the heating elements 117 thereby creating steam. The steam rises into the steam chamber 114 and permeates the inside of the steam chamber 114. Food ingredients placed on the shelving unit 113 within the steam chamber 114 are kept warm by the rising steam and the heat radiated by the upper element 117. As the steam continues to rise within the steam chamber 114, it reaches the top of the steam chamber 114 where it comes into contact with the heating element 118. The heating element 118 emits heat of a predetermined temperature sufficient to cause the steam to dissipate thereby preventing moisture from accumulating on the top surface within the steam chamber 114 and raining down on the food ingredients positioned on the shelving unit 113. The exhaust system 116 expels steam from the steam chamber 114 to permit newly formed steam to circulate within the steam chamber 114. The manual vane 111 included in the exhaust system 116 is manually adjustable to create a gap at the top of the steam chamber 114. The gap, which can be widened or closed, permits steam and heat within the chamber to escape into the atmosphere. The gap is manually adjusted to create a gap of a certain width to allow steam and heat to be expelled from the steam chamber 114, while maintaining a temperature within the steam chamber 114 that is sufficient to keep the ingredients warm.

The laminar air curtain 110 permits an individual to reach into the steam chamber 114 to withdraw food ingredients without the having to open a door. The swinging door 112 decreases the distance which the heated air flow must span to create an effective air curtain 110. An access door 115, located in the rear of the steam cabinet 100, permits an individual to load food ingredients into the steam chamber 114 to be prepared, while not interfering with an individual withdrawing food ingredients through the air curtain 110.

Figures 8-12 illustrate a wrap packaging storage system 150. The system involves a wrap storage shelf 152 configured to receive a container 158, 162. A securing slot 156 extends along substantially the full length of the bottom surface 153 of the wrap storage shelf 152. The bottom surface 153 is desirably indented along substantially its entire length to form the slot 156. The side panels 155 of the wrap storage shelf 152 are configured with an attachment means 154 for hanging the wrap storage shelf from at least one rod 157. For example, the hooks 154 defined by or attached to the side panels 155 of the wrap storage shelf 152 would be suitable attachment means. The hooks 154 define an aperture 159 and are configured to receive a rod 157.

As mentioned above, it will be understood that the wrap storage shelf system 150 is modular in nature and may be positioned at any point along the preparation line 1 where a rod 157 is mounted. The wrap storage shelves 152 can be produced in any number of sizes as well to fit within the preparation line 1 where necessary. Moreover, shelves 152 can accommodate wrap containers 162, 158 of varying shapes and sizes to accommodate different packaging corresponding to different products.

The wrap storage shelves 152 are configured to receive containers 162, 158. As shown in Figures 10 and 11, the container 162 is defined by two side panels 165,169, a rear panel 167, a front panel 163 and a bottom panel 171. An aperture 168 is configured on the front panel 163. Flanges 164, 166 are mounted on the bottom surface 171 of the container 162. Flange 164 is angled forward to a sufficient degree to permit it to interlock with the slot 156 of the wrap storage shelves 152. Flange 164 may alternatively be angled backward. Flange 166 will extend approximately

perpendicular to the bottom surface 171 of the container 162. A hole 170 is defined by the perpendicular flange 166, the front panel 163 and side panels 165,169.

As best illustrated by Figure 12, a wrap container 158 is fitted with a flange 160 which depends approximately perpendicular from the bottom surface 175 of the wrap container 158. The bottom surface 175 further defines a lower shelf of the wrap container 158. A second shelf is defined by an intermediate panel 177 positioned between side panels 178,179 and parallel to the bottom panel 175.

The wrap storage shelf 152 hangs from the rod 157 through the hook 154. The rod 157 is mounted along needed points on the preparation line 1. Placed at predetermined points along the rod 157 are supports. The supports are mounted to the food preparation line 1 and are connected to the rod 157. The supports are spaced at a distance that is sufficient to prevent the rod 157 from bowing under the load of the shelf 152 and containers 162, 158.

Wrap containers 162 and 158 are placed in the wrap storage shelf 152. The angled flange 164 underneath the bottom surface 171 of the container 162 will slide into the slot 156 on the inside bottom surface 153 of the wrap storage shelf 152. This will prevent the container 162 from sliding off the shelf 152 when a carton is removed from the container 162. The product packaging is removed from the wrap container 162 through the hole 170. Advantageously, an individual can secure the product packaging at aperture 168 and pull the packaging out through the hole 170.

The perpendicular flange 166 will prevent the wrap container 162 from being pushed backwards thereby displacing the angled flange 164 on the container 162 from the slot 156 on the wrap storage shelf 152. To remove the container 162 from the wrap storage shelf 152, the container 162 is lifted from the thumb hole 168 in a vertical direction to a height sufficient for the perpendicular flange 166 to clear the front edge 151 of the wrap storage shelf 152. Then the wrap container 162 is pushed backwards so that the angled flange 164 can clear the slot 156 at which time the entire wrap container 162 can be lifted out of the wrap storage shelf 152.

The wrap container 158 does not have an angled flange fitting into the slot 156 of the wrap storage shelf 152. Instead, the wrap container 158 is positioned within the wrap storage shelf 152. The wrap container 158 stores product packaging on

shelves 175, 177, and the product packaging is pulled from the top of a pile of packaging on each shelf 175, 177.

As illustrated in Figures 13-14B, the ingredient dispenser 120 is positioned in the corner 9 of the product line 1. The ingredient dispenser 120 is positioned within a cabinet 121 out of plain view. The cabinet 121 includes a heated compartment in which the hoppers 124 of the system 120 are located. Access to the hoppers 124 is gained through a rear access door located on the rear side of the first line section 3. A controller 33 (Figure 3) communicates with internal sensors within the heated compartment and regulates the corresponding heating elements to control the temperature of the ingredients within the hoppers 124.

A mixing motor 123, positioned within the cabinet 121 and above the hopper 124, operates a mixer 122. The mixer 122 extends into the ingredient (not shown) within the hopper 124. The hopper 124 is in communication with a two-position valve 130. In the first position, as illustrated in Figure 14a, the valve 130 is connected to the piston chamber 144. In the second position, as illustrated in Figure 14b, the valve 130 is in communication with an outlet port 136. The outlet port 136, in turn, is in communication with an outlet tube 125. Dispensing nozzles 126 are configured at the end of the outlet tube 125. Desirably, each tube 125 is wrapped with a conventional heating blanket (not shown), such as those commercially available from Watlow of St. Louis, Missouri, to maintain the ingredient within the tube 125 at a desired temperature. A controller 33 (Figure 3) operates the heating blankets. The dispensing nozzles 126 hang down from an overhead cabinet 128.

A positive displacement pump assembly 140 and valve 130 found to be suitable as components of the ingredient dispenser 120 of the present invention is a pump and valve assembly manufactured and distributed by Itoh Kouki of Japan.

Figure 14A illustrates a two-position valve 130 in communication with a piston pump assembly 140. An inlet port 134 is interposed between the hopper 124 and the two-position valve 130. An outlet port 136 is interposed between the two-position valve 130 and the outlet tube 125. The valve member 132 of the valve 130 is in an intake position. A piston chamber 144 extends outward from the valve 130. Within the piston chamber 144, a piston 142 is withdrawn from the piston chamber 144.

As illustrated in Figure 14B, the valve member 132 is in an outlet position. Further, the piston 142 is fully inserted within the piston chamber 144.

The hopper 124, which holds a predetermined amount of ingredient 127, is loaded from the top when it becomes low. The quantity of ingredient 127 in each hopper 124 desirably is sufficient to not require restocking during extended periods of use. For example, the quantity of supply can be sufficient to not require any additional stocking during a three-hour lunch period in the middle of the afternoon.

As illustrated in Figures 13 and 14A, to operate the ingredient dispenser 120, compressed air drives an actuator 129 which, in turn, drives the piston 142. A conventional compressor supplies the compressed air to the air cylinders.

To dispense ingredient, the piston 142 is fully withdrawn from the piston chamber 144. This pulls ingredient 127 from the hopper 124, through the inlet port 134 and into the valve chamber 133 and piston chamber 144. The back-pull of the piston 142 withdraws a precise, predetermined amount of ingredient 127 into the valve chamber 133 and piston chamber 144. In doing so, the valve member 132, within the valve chamber 133, is rotated by a second actuator 138 (Figure 13) in a counter-clockwise direction to the position illustrated in Figure 14B. As illustrated in Figures 13 and 14B, the air cylinder 129 then drives the piston 142 forward within the piston chamber 144. This, in turn, forces the ingredient 127 through the piston chamber 144, into the valve chamber 133, and out through outlet port 136. Because a quantity of ingredient 127 is perpetually present in the outlet tube 125, the same proportion of ingredient withdrawn from the hopper 124 by the piston 142 and driven through the outlet port 136 will expel through nozzle 126.

The counterclockwise rotation of the valve member 132 from the position illustrated in Figure 14A to the position illustrated in 14B, effectively blocks the inlet port 134 and then the piston 142 forces the ingredient 127 through outlet port 136. This operation will repeatedly dispense approximately the same proportion of the ingredient 127.

The ingredient dispenser 120 also includes a red sauce dispensing mechanism in which a submergible pump is located within a container of red sauce. The container is positioned within the heated compartment within the cabinet 121. A

delivery line extends from the pump to a discharge nozzle located adjacent the dispenser nozzle 126.

Figure 15 illustrates another embodiment of a food preparation line. The embodiment of Figure 15 in generally configured in accordance with the embodiment of Figure 1. The third section in the embodiment of Figure 15, however, desirably is angled relative to the first section. The angle is preferably about 45° but may vary over a broad range as can be appreciated by those skilled in the art. Importantly, the distance between the open produce bin 32 and the packaging containers 150 is less than about six feet. The distance is desirably determined by the average arm span of a worker. Additionally, the distance between the heated storage container and the steam table is similarly determined by the average arm span of a worker and is less than about six feet.

Although the foregoing invention has been described in terms of an illustrated embodiment, other embodiments will become apparent to those of ordinary skill in the art, in view of the disclosure herein. Accordingly, the present invention is not intended to be limited by the recitation of illustrated embodiment.